(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
15 November 2001 (15.11.2001)

PCT

(10) International Publication Number
WO 01/86828 A1

(51) International Patent Classification[7]: H04B 1/38, H04M 1/60

(21) International Application Number: PCT/GB01/02015

(22) International Filing Date: 9 May 2001 (09.05.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0011139.3 10 May 2000 (10.05.2000) GB

(71) Applicant *(for all designated States except US)*: **JK MICROTECHNOLOGY LIMITED** [GB/GB]; Sittingbourne Research Centre, 740 Heeley Close, Sittingbourne, Kent ME9 8HL (GB).

(71) Applicants and
(72) Inventors: **KHALID, Ata-ul-Habib** [GB/GB]; 54 St. Marys Road, Gillingham, Rochester, Kent ME7 1JJ (GB). **LUCK, James** [GB/GB]; 3 Cadnam Close, Strood, Rochester, Kent ME2 3TS (GB).

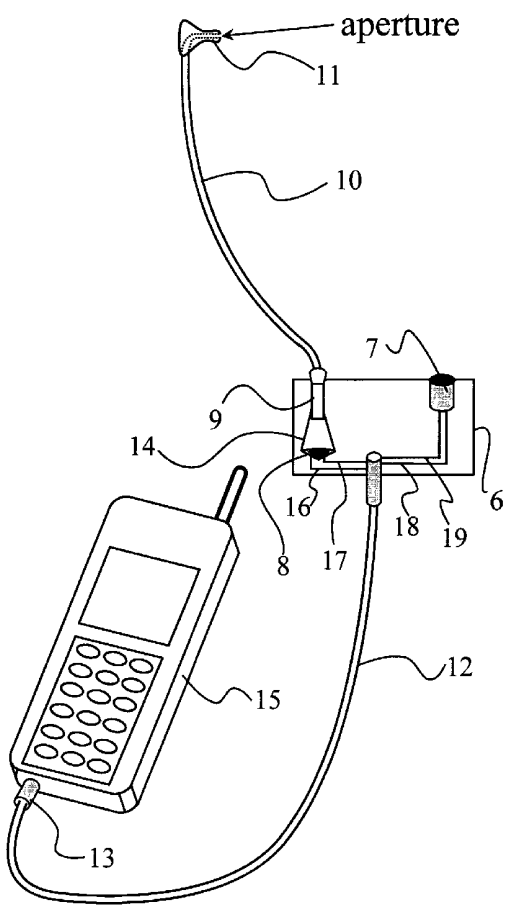
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,

[Continued on next page]

WO 01/86828 A1

(54) Title: REDUCED RADIATION AUDIO HEADSET



(57) Abstract: An apparatus in the form of an audio headset for use with, for example mobile telephones, computers, hand-held computers, Personal Digital Assistants (PDAs) or the like in which the loudspeaker and the microphone are contained within an enclosure and the communications link between the loudspeaker of said headset and the earpiece of said headset is a non-metallic acoustic conduit, for example a silicon rubber tube. By forming the communications link from a non-metallic material which cannot act as a conduit for microwave radiation the microwave radiation generated by the said telephone and incident at the user's head is significantly reduced compared to an audio head-set whereby the communication link to the said earpiece is made from electrical wires.

IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designationsAE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG)*

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Reduced Radiation Audio Headset

This invention relates to an audio headset, which can be used with, for example, mobile telephones, computers, hand-held computers, Personal Digital Assistants (PDAs) and the like.

An example of an existing headset, for example as used with a mobile telephone, is shown in Figure 1. Said headset commonly comprises an earpiece 1 and a microphone 2 connected to an existing mobile telephone 15 via an electrical cable 3 and a plug 4. The cable 3 may be clipped to the clothing of the user with the clip 5. In normal use the earpiece 1 is placed in the user's ear. It has been shown that such cables act as a conduit for microwave energy, conducting said energy from the mobile telephone directly to the user's head. It has been reported that use of conventional headsets increase the level of microwave radiation incident at the head of the user by a factor of three compared with using the telephone itself adjacent to the ear. (Which April 2000, p.15, Consumer's Association). The effects upon the user of microwave radiation at the levels commonly found to be emitted from mobile telephones are not fully understood, but there is evidence to suggest a link between said radiation and ill effects in the users of mobile telephones. It is evident that mobile telephone users are concerned about the possible harmful effects of said microwave radiation and a device that reduced the incidence of said microwave radiation upon the user's head would be welcomed.

The clock frequencies of computers intended for personal use are increasing annually with clock frequencies of 1.2GHz (1 GHz = 1×10^9 Hertz) currently available. It is considered to be only a matter of time before the clock frequencies of such apparatus reach that of mobile telephones (e.g. 1.8GHz) or that of microwave ovens (2.45GHz) at such a time the hazards that are currently suspected of being associated with mobile telephones may also become suspected of being associated with said computers.

Standardized personal area network (PAN) technologies such as Bluetooth™ utilize 2.45GHz spread spectrum radio to provide connectivity over distances of typically 1 to 10m. Such networks are currently used to provide audio to headsets for example in hands-free kits for mobile telephones phones. The use of the 2.45GHz frequency band may give user's cause for concern about the possible harmful effects of said microwave radiation.

A mobile telephone as disclosed in patent GB2340691A is an invention comprising a handset, containing an earpiece and microphone, and another unit containing a transmitter. Said invention enables the transmitter to be located a suitable distance from the user while the telephone is in use and several techniques, which did not involve the use of microwave radiation, were described for exchanging speech and control signals between the two units. This resulted in the microwave radiation incident upon the user's head being reduced compared to a mobile telephone operated adjacent to the user's ear or a mobile telephone operated with a conventional (electrically connected) headset.

A major deficiency of the invention described in patent GB2340691A is that the earpiece and microphone were incorporated into a handset and as such required the use of the user's hand to operate the telephone. Such a requirement impedes the use of the telephone in a moving vehicle or in any other situation where the user would preferentially have both hands free of the telephone.

The first object of the present invention is to provide an apparatus that is in essence a headset for use with mobile telephones, computers, hand-held computers, Personal Digital Assistants (PDAs) or the like in which the loudspeaker and the microphone are contained within an enclosure and the communications link between the loudspeaker of said headset and the earpiece of said headset is an acoustic conduit, for example a silicon rubber tube.

The second object of the present invention is to provide a headset for use with a mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like whereby the microwave radiation generated by the said mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like and incident at the user's head is reduced significantly compared to a headset whereby the communication channel between the earpiece of the headset and the said mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like is entirely an electrical wire or wires.

According to the first aspect of the present invention there is provided an apparatus in the form of a headset for use with a mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like, in which the loudspeaker and the microphone are contained within an enclosure and the communications link between the earpiece of said headset and the mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like is an acoustic conduit, for example a silicon rubber tube.

According to the second aspect of the present invention there is provided an apparatus in the form of a headset for use with a mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like, which can perform its function with the terminal or terminals of any or all electrical wire or wires connected to the mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like separated from the user's head by a distance typically in excess of, though it may be less than, 30cm.

According to the third aspect of the present invention there is provided an apparatus in the form of a headset for use with a mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like in which the communications link between the said mobile telephone, computer, hand-held computer, Personal Digital Assistant or the like and the speaker and microphone of the headset is in the form of, for example but not limited to, an electrical wire or wires, an infra-red link, a radio link, a Bluetooth™ radio link, an inductive-loop link, a fibre-optic link or an ultrasonic link.

Figure 1 is a perspective view of an existing example of a headset.

Figure 2 is a schematic diagram of the first embodiment of the present invention.

Figure 3 shows the enclosure containing the microphone and loudspeaker and the clip detail.

Figure 4 is a schematic diagram of the second embodiment of the present invention.

Figure 5 is a schematic diagram of the third embodiment of the present invention with a cut away to show enclosed microphone and loudspeaker.

Figure 6 is a schematic diagram of the fourth embodiment of the present invention with a cut away to show enclosed microphone and loudspeaker and tube section detail.

The first preferred embodiment of the present invention will be described by way of a non-restrictive example with reference to Figures 2 and 3. Enclosure 6 contains loudspeaker 8 electrically connected to electrical cable 12 via electrical wires 16 and 17 and microphone 7 electrically connected to electrical cable 12 via electrical wires 18 and 19. Loudspeaker 8 is mechanically connected to tube 9 via hollow cone 14 and thence to silicon-rubber or the like tube 10. Tube 10 terminates at earpiece 11, a hollow construction of moulded plastic or the like. The arrangement of components 8, 14, 9,10 and 11 is such that any sound generated by loudspeaker 8 will be conducted to the aperture in the earpiece 11 via components 14, 9 and 10. The user's voice is collected by microphone 7 and conveyed as an electrical signal to the mobile telephone via electrical wires 18 and 19 and electrical cable 12. Electrical cable 12 is connected to existing mobile telephone 15 via connector 13. Enclosure 6 may be attached to the clothing of the user by removable clip 20 (not shown on Figure 2) or alternatively suspended from earpiece 11 by the acoustic conduit, for example silicon-rubber tube, 10.

The second preferred embodiment of the present invention will be described by way of a non-restrictive example with reference to Figure 4. Enclosure 6 contains microphone 7, electrically connected to transmit/receive unit 25, for example utilizing the Bluetooth™ protocol, via electrical wires 18 and 19. Loudspeaker 8 is mechanically connected to pipe 9 via hollow cone 14 and thence to silicon-rubber or the like tube 10. Tube 10 terminates at earpiece 11, a hollow construction of moulded plastic or the like. The arrangement of components 8, 14, 9,10 and 11 is such that any sound generated by loudspeaker 8 will be conducted to the aperture in the earpiece 11 via components 14, 9 and 10. The user's voice is collected by microphone 7 and conveyed as an electrical signal to transmit/receive unit 25, for example utilizing the Bluetooth protocol, via electrical wires 18 and 19.

The transmit/receive unit 25, for example utilizing the Bluetooth™ protocol, communicates with the mobile telephone 15 via transmit/receive unit 24, for example utilizing the Bluetooth protocol attached to the electrical connector on the telephone 15. The combined transmit/receive unit 25, for example utilizing the Bluetooth™ protocol coverts the electrical analogue of the received sound present on wires 18 and 19 into a

suitably modulated signal. Said signal is transmitted over path 26 and received by a suitable receiver circuit in transmit/receive unit 24, for example utilizing the Bluetooth protocol and converted into an electrical analogue of the audio signal suitable for reception by the telephone 15. The demodulated audio signal received by the telephone 15 is fed to transmit/receive unit 24, for example utilizing the Bluetooth protocol, converted into a suitably modulated signal and transmitted from transmit/receive unit 24, for example utilizing the Bluetooth protocol. Said signal is received by transmit/receive unit 25, for example utilizing the Bluetooth protocol and converted into an electrical analogue of the audio signal and fed to loudspeaker 8 via wires 16 & 17. Enclosure 6 may be attached to the clothing of the user by removable clip 20 (not shown on Figure 4).

The third preferred embodiment of the present invention will be described by way of a non-restrictive example with reference to Figure 5. Enclosure 6 contains loudspeaker 8 and microphone 7. Enclosure 6 is located with the mobile phone 15. Loudspeaker 8 is mechanically connected to pipe 9 via hollow cone 14 and then to silicon-rubber or the like tube 10. Tube 10 terminates at earpiece 11, a hollow construction of moulded plastic or the like. The arrangement of components 8, 14, 9,10 and 11 is such that any sound generated by loudspeaker 8 will be conducted to the aperture in the earpiece 11 via components 14, 9 and 10. The user's voice is collected by microphone 7 via aperture 27 in the body of mobile phone 15.

The fourth preferred embodiment of the present invention will be described by way of a non-restrictive example with reference to Figure 6. Enclosure 6 contains loudspeaker 8 and microphone 7. Enclosure 6 is located with the mobile phone 15. Loudspeaker 8 is mechanically connected to pipe 9 via hollow cone 14 and then to silicon-rubber or the like tube 10. Tube 10 terminates at earpiece 11, a hollow construction of moulded plastic or the like. The arrangement of components 8, 14, 9,10 and 11 is such that any sound generated by loudspeaker 8 will be conducted to the aperture in the earpiece 11 via components 14, 9 and 10. Microphone 7 is mechanically connected to pipe 29 via hollow cone 28 and then to silicon-rubber or the like tube 30. The termination of the tube 30 is such that it is approximately 30cms from the earpiece 11. The open aperture 31 of tube 30 collects the user's voice and conveys it via components 30,29 and 28 to microphone 7. Pipes 9 and 29 can be removed cones 14 and 28 respectively, allowing the tubes to be disconnected when the headset is not required and thereby allowing the mobile phone 15 to function as a conventional phone without the headset.

Obviously, many modifications and variations of the present invention are possible now that the present invention has been disclosed. Therefore, it is to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described above.

Bluetooth™ is a trademark of Telefonaktiebolaget LM Ericsson Sweden.

Claims

1. An apparatus in the form of a headset for use with a mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like in which the loudspeaker and the microphone are contained within an enclosure and the communications link between the loudspeaker of said headset and the earpiece of said headset is an acoustic conduit, for example a silicon rubber tube.

2. An apparatus according to Claim 1, which can perform its function with the terminal or terminals of any or all electrical wire or wires that form part of the headset are separated from the user's head by a distance typically in excess of, though it may be less than, 30cm.

3. An apparatus according to Claim 1 whereby the sound generated by the loudspeaker is coupled into the acoustic pipe by a hollow cone.

4. An apparatus according to Claims 1,2 and 3 in which the communications link between the user and the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like comprises in part a loudspeaker contained within an enclosure and connected to the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like via an electrical cable comprising at least one electrical wire.

5. An apparatus according to Claims 1,2 and 3 in which the communications link between the user and the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like comprises in part a microphone contained within an enclosure and connected to the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like via an electrical cable comprising at least one electrical wire.

6. An apparatus according to Claims 1,2 and 3 in which the communications link between the loudspeaker and microphone of the headset, contained within their enclosure, and the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like is a radio link.

7. An apparatus according to Claims 1,2 and 3 in which the communications link between the loudspeaker and microphone of the headset, contained within their enclosure, and the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like is an infra-red link.

8. An apparatus according to Claims 1,2 and 3 in which the communications link between the loudspeaker and microphone of the headset, contained within their enclosure, and the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like is a radio link employing the Bluetooth™ protocol.

9. An apparatus according to Claims 1,2 and 3 in which the communications link between the loudspeaker and microphone of the headset contained within their enclosure and the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like is an inductive-loop link.

10. An apparatus according to Claims1,2 and 3 in which the communications link between the loudspeaker and microphone of the headset contained within their enclosure and the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like is an ultrasonic link.

11. An apparatus according to Claims 1, 2 and 3 in which the enclosure containing the loudspeaker and microphone can be attached to the clothing of the user by a clip or suspended from the ear of the user by the acoustic conduit.

12. An apparatus according to Claims 1, 2 and 3 in which the enclosure containing the loudspeaker and microphone is itself contained within the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like and the acoustic conduit used to convey sound from the loudspeaker to the earpiece is attached to the cone via a suitable plug and socket.

13. An apparatus according to Claims 1, 2 and 3 in which the enclosure containing the loudspeaker and microphone is itself contained within the mobile telephone, computer, hand-held computer, Personal Digital Assistant (PDA) or the like and the acoustic conduit used to convey sound from the loudspeaker to the earpiece is attached to the cone channeling sound from the loudspeaker via a suitable plug and socket and the acoustic conduit used to convey to user's voice to the cone channeling sound to the microphone is attached to said cone via a suitable plug and socket.

14. Apparatus substantially as described herein with reference to Figures 2,3,4,5 and 6 of the accompanying drawing.

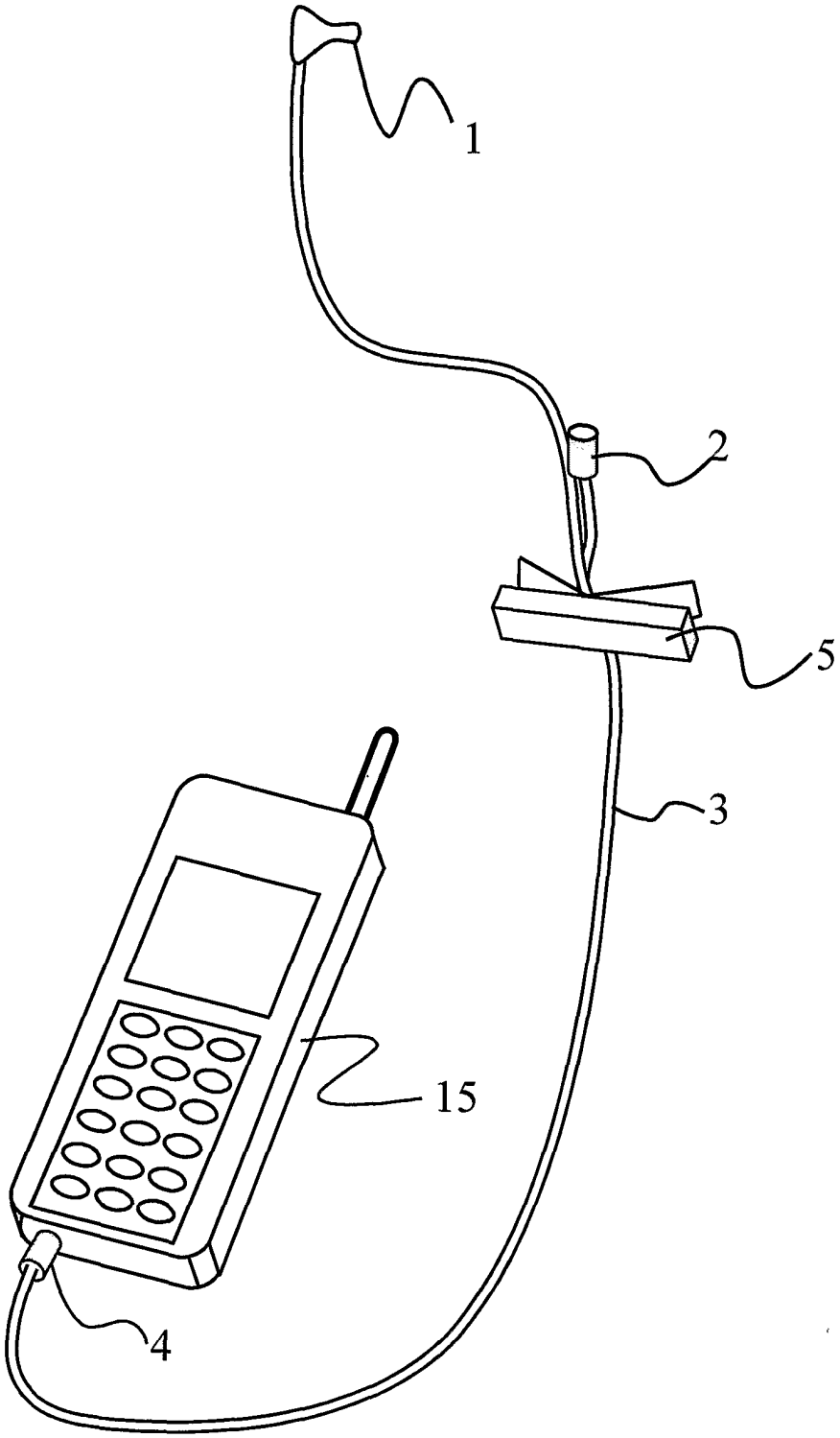


Figure1

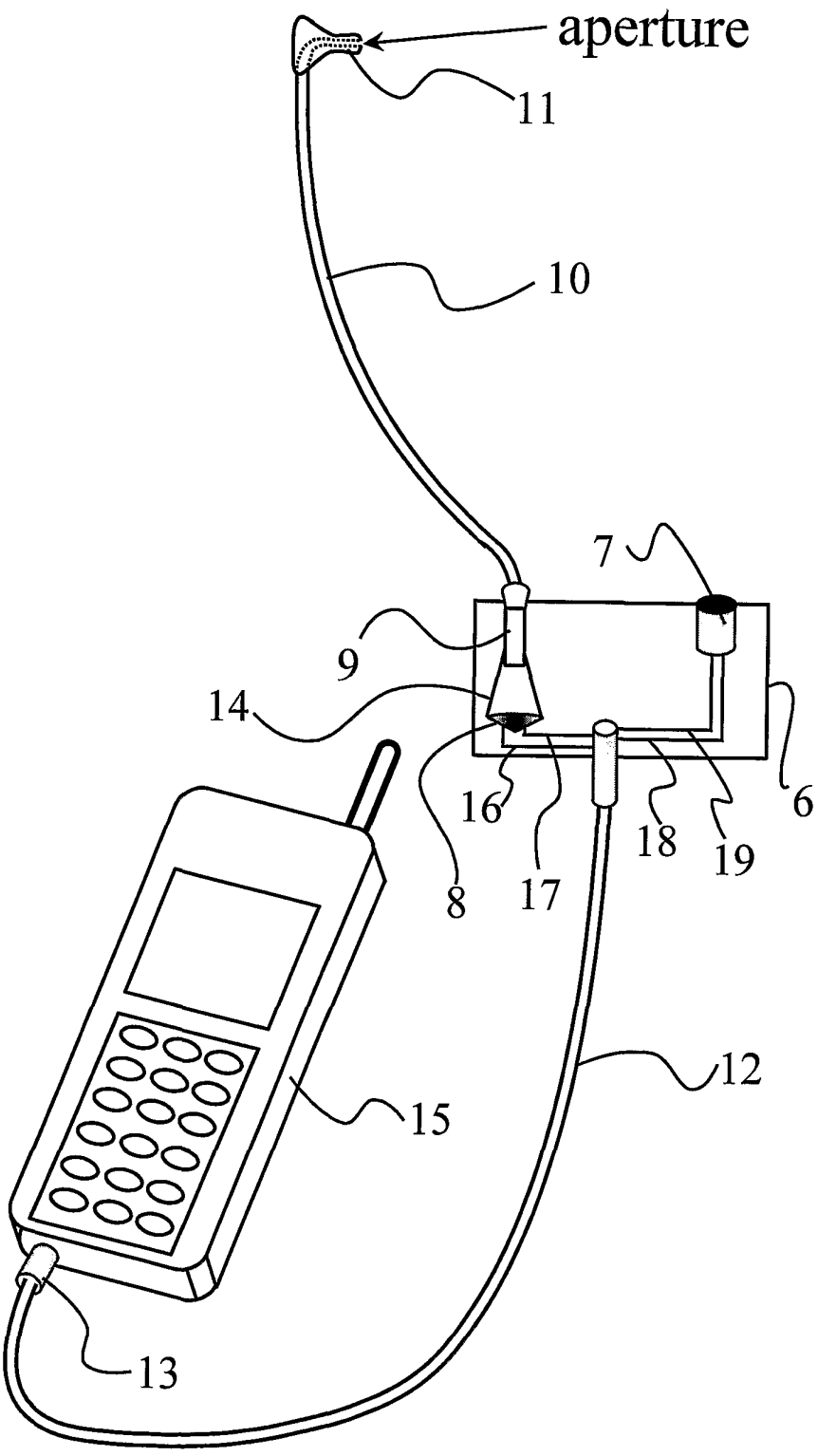


Figure 2

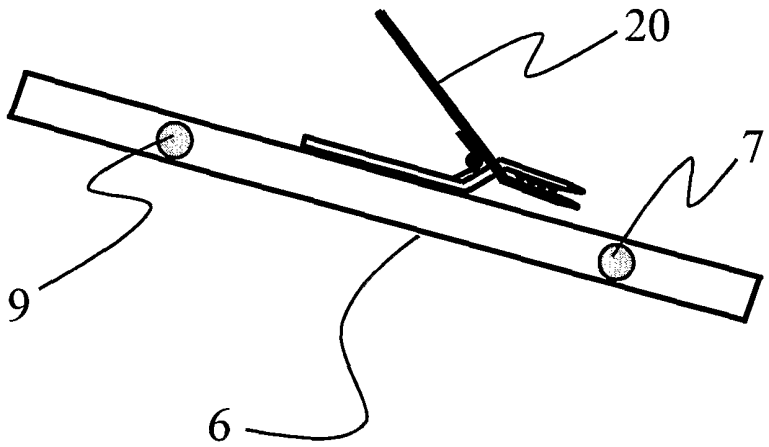


Figure 3

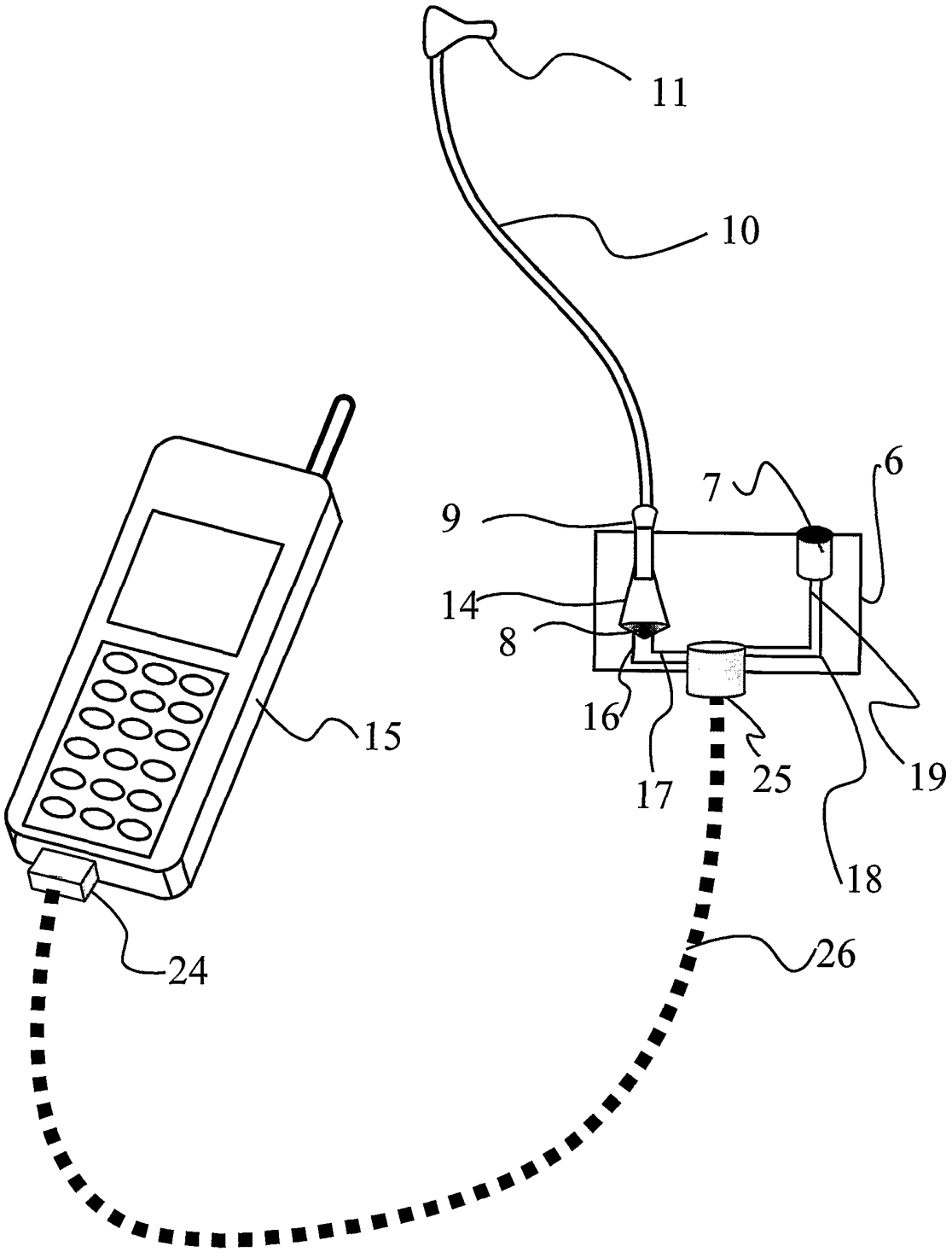


Figure 4

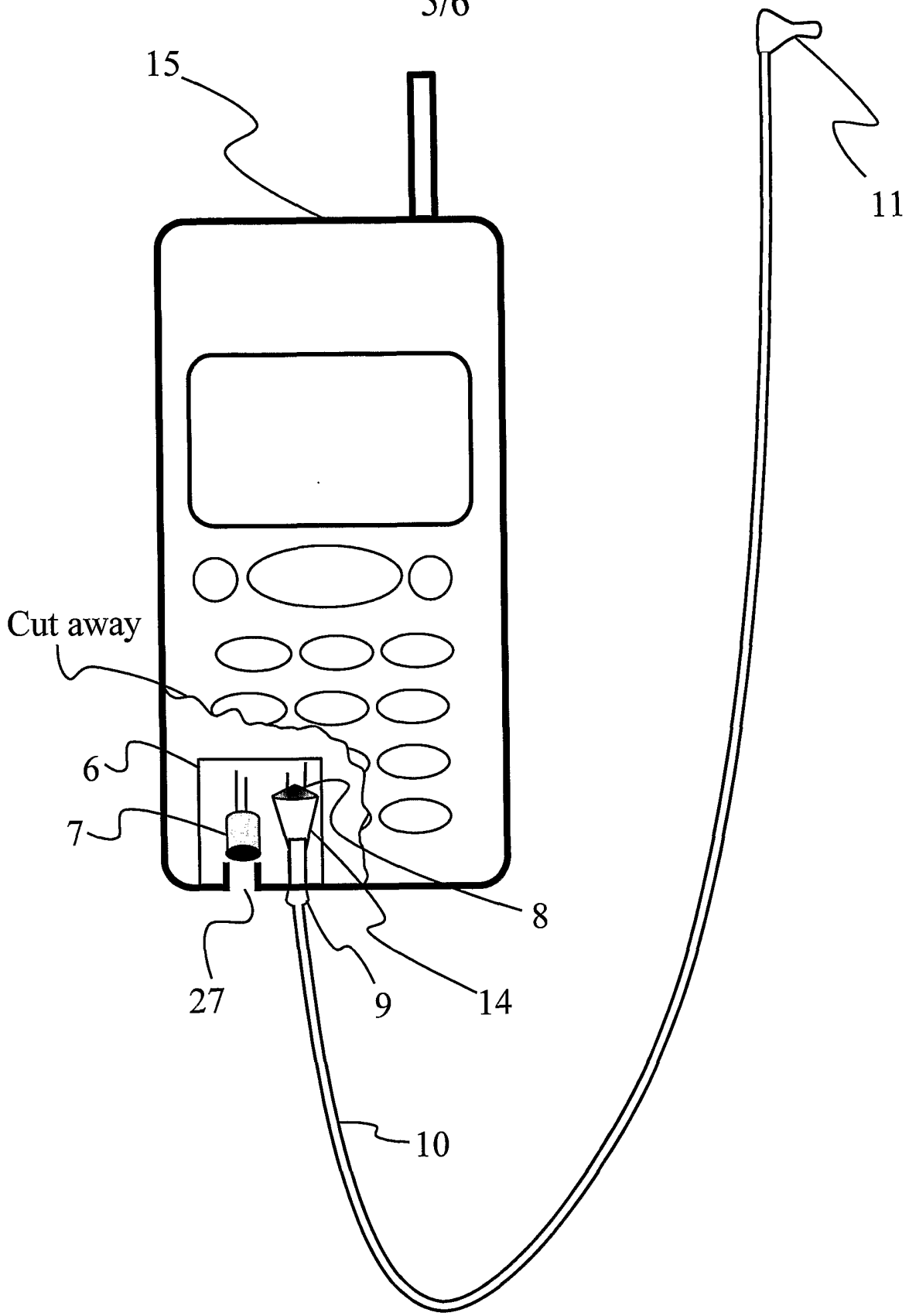


Figure 5

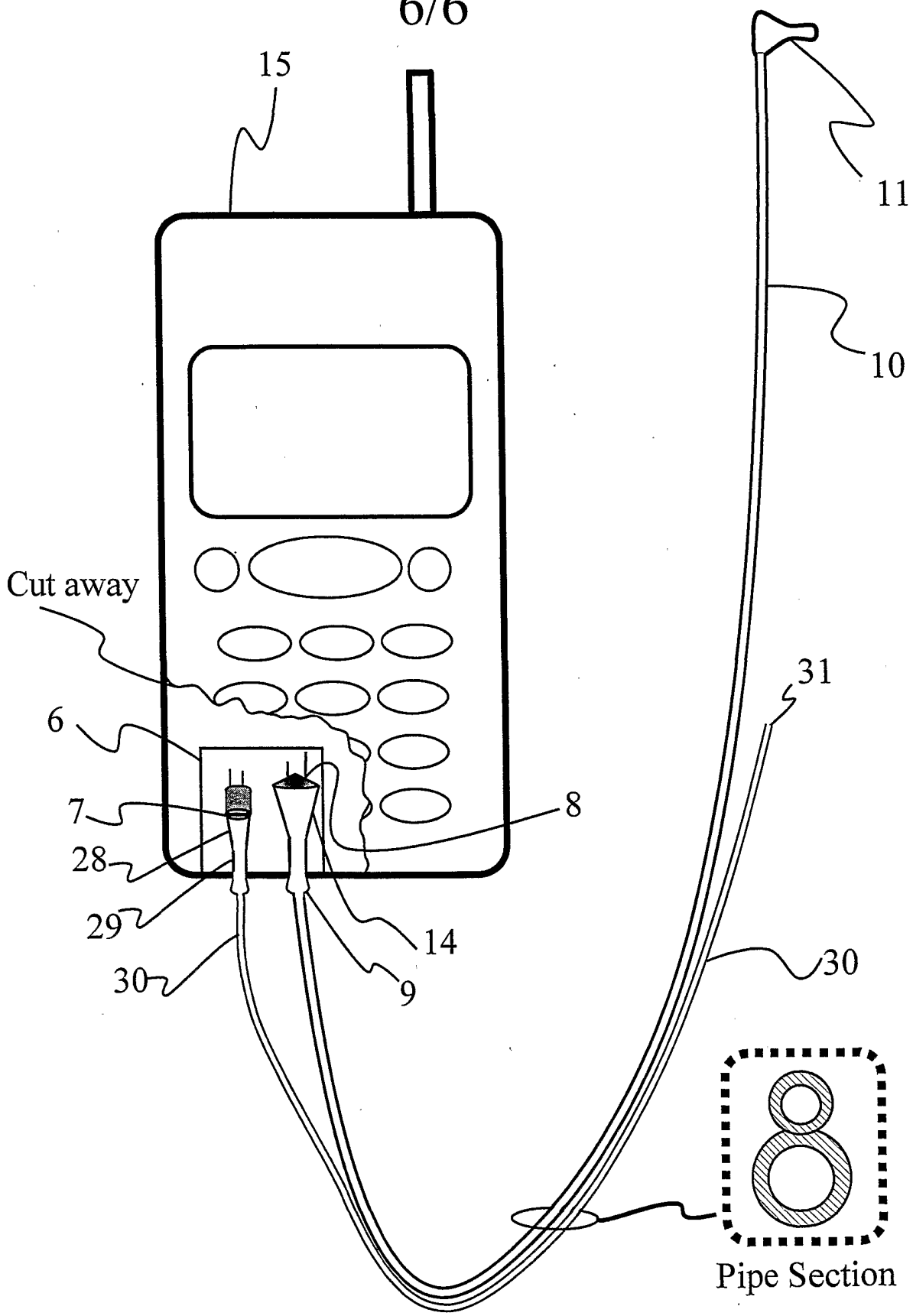


Figure 6

INTERNATIONAL SEARCH REPORT

Int ɔnal Application No
PCT/GB 01/02015

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H04B1/38 H04M1/60

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 H04B H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 5 943 627 A (KIM SEONG-SOO ET AL) 24 August 1999 (1999-08-24) abstract column 3, line 7 -column 6, line 36 figures 2,9,11	1,4-7,9, 11,14 2,3,8, 10,12,13
A	WO 98 20661 A (MINCHIN ALISON MARGARET ;AUST INDO TECH PTY LIMITED (AU); MINCHIN) 14 May 1998 (1998-05-14) abstract figures 5,6 page 4, line 8 - line 14	1-14

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 September 2001	28/09/2001

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Tzimeas, K

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/GB 01/02015

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
P,A	DE 200 14 065 U (WEI OSCAR ;HUNG CHIN SHUI (TW)) 12 October 2000 (2000-10-12) abstract figures 1,4,5 page 5 -page 7	1-14
A	US 5 208 867 A (STITES III GEORGE M) 4 May 1993 (1993-05-04) abstract column 10, line 15 -column 11, line 63 figure 5	1-14
A	GB 2 340 691 A (UNIV BRISTOL) 23 February 2000 (2000-02-23) cited in the application abstract figures 2-6	6-10
A	US 5 982 764 A (BUTLER NEAL R ET AL) 9 November 1999 (1999-11-09) abstract figures 2,3,7	9

INTERNATIONAL SEARCH REPORT

Intl ›nal Application No
PCT/GB 01/02015

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5943627 A	24-08-1999	KR 212686 B1	02-08-1999
		KR 153636 Y1	02-08-1999
		CN 1176569 A	18-03-1998
		DE 19706335 A1	02-04-1998
		GB 2317301 A ,B	18-03-1998
		JP 2918510 B2	12-07-1999
		JP 10107881 A	24-04-1998
WO 9820661 A	14-05-1998	AU 4856397 A	29-05-1998
		WO 9820661 A1	14-05-1998
DE 20014065 U	12-10-2000	DE 20014065 U1	12-10-2000
US 5208867 A	04-05-1993	WO 9425957 A1	10-11-1994
		AU 4368493 A	21-11-1994
		US 5327506 A	05-07-1994
GB 2340691 A	23-02-2000	NONE	
US 5982764 A	09-11-1999	US 5912925 A	15-06-1999
		EP 0920746 A2	09-06-1999
		JP 2000515351 T	14-11-2000
		WO 9848526 A2	29-10-1998
		CA 2221364 A1	21-11-1996
		CN 1190506 A	12-08-1998
		EP 0872032 A1	21-10-1998
		JP 11505395 T	18-05-1999
		WO 9637052 A1	21-11-1996
		US 5771438 A	23-06-1998
		WO 9807244 A2	19-02-1998